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INDEX OF ROCK MECHANICS RESEARCH REPORTS: CANMET/MINING RESEARCH LABORATORIES, 1964-1984

REPERTOIRE DES RAPPORTS DE RECHERCHE SUR LA MÉCANIQUE DES ROCHES: CANMET/LABORATOIRES DE RECHERCHE MINIÈRE, 1964-1984

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David G. Hedley and John E. Udd

Mining Research Laboratories

February 1985

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Laboratoires de recherche minière

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INDEX OF ROCK MECHANICS RESEARCH REPORTS: CANMET/MINING RESEARCH LABORATORIES, 1964-1984

David G. Hedley* and John E. Udd**

Abstract

A total of 251 reports on underground hard-rock mining, prepared by staff of the Mining Research Laboratories during the period from 1964 to 1984, are listed. The bibliography is organized into eleven subject categories ranging from rock testing and classification, through modelling, mining methods and bulk mining, to rockbursts and seismicity. Within each category the reports are listed in chronological order.

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RÉPERTOIRE DES RAPPORTS DE RECHERCHE SUR LA MÉCANIQUE DES ROCHES: CANMET – LABORATOIRES DE RECHERCHE MINIÈRE, 1964-1984

David G. Hedley* et John E. Udd**

Résumé

On a dressé une liste de 251 rapports sur l'exploitation minière souterraine de roche dure, préparés par le personnel des Laboratoires de recherche minière au cours de la période allant de 1964 à 1984. La bibliographie est divisée en onze catégories par sujets allant de l'étude et la classification des roches, de la mise au point de modèles, de méthodes d'exploitation minière et d'exploitation minière en vrac, aux coups de toit et à l'activité sismique. De plus, à l'intérieur de chaque catégorie, les rapports figurent dans l'ordre chronologique.

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CONTENTS

ABSTRACT i

RÉSUMÉ iii

INTRODUCTION 1

ROCK TESTING AND CLASSIFICATION 3

STRESS MEASUREMENTS AND INSTRUMENTATION 6

OTHER INSTRUMENTATION 9

STRUCTURAL GEOLOGY 11

MODELLING (MATHEMATICAL, PHYSICAL, COMPUTER) 12

SUPPORT SYSTEMS 16

ROOM-AND-PILLAR MINING (ELLIOT LAKE) 17

CUT-AND-FILL INCLUDING BACKFILL TESTING 19

BULK MINING (SUDBURY, ALGOMA, KIDD CREEK) 21

ROCKBURSTS AND SEISMICITY 22

TEXTBOOKS AND STATE-OF-THE-ART REVIEWS 23

TABLE DES MATIÈRES

ABSTRACT i

RÉSUMÉ iii

INTRODUCTION 2

VÉRIFICATION ET CLASSIFICATION DES ROCHES 3

MESURE DES CONTRAINTES ET APPAREILLAGE 6

AUTRE APPAREILLAGE 9

GÉOLOGIE STRUCTURALE 11

MODÉLISATION (MATHÉMATIQUE, PHYSIQUE, ASSISTÉE PAR ORDINATEUR) 12

SYSTÈMES DE SOUTÈNEMENT 16

EXPLOITATION PAR CHAMBRES ET PILIERS (ELLIOT LAKE) 17

EXPLOITATION PAR DÉBLAYAGE ET REMBLAYAGE, Y COMPRIS LE CONTRÔLE DU REMBLAYAGE 19

EXPLOITATION EN VRAC (SUDBURY, ALGOMA, KIDD CREEK) 21

COUPS DE TOIT ET SISMICITÉ 22

MANUELS ET ÉTUDES RÉCENTES 23

INTRODUCTION

This report contains listings, in eleven selected categories, of all of the rock-mechanics research reports, relevant to underground hard-rock mining, which have been issued by the Mining Research Laboratories of CANMET during the period 1964-1984. Other reports written during these two decades which apply to both soft-rock and open pit-mining have been excluded.

For purposes of organization the reports have been listed chronologically according to the following categories:

- Rock Testing and Classification
- Stress Measurements and Instrumentation
- Other Instrumentation
- Structural Geology
- Modelling (Mathematical, Physical, Computer)
- Support Systems
- Room-and-Pillar Mining (Elliot Lake)
- Cut-and-Fill, Including Backfill Testing
- Bulk Mining (Sudbury, Algoma, Kidd Creek)
- Rockbursts and Seismicity
- Textbooks and State-of-the-Art Reviews.

In all, 251 reports are included in the lists.

INTRODUCTION

Ce rapport comprend un répertoire, divisé en onze catégories sélectionnées, de tous les rapports de recherche sur la mécanique des roches portant sur l'ex- ploitation minière souterraine de la roche dure publiés par les Laboratoires de recherche minière du CANMET cans la période allant de 1964 à 1984. Les titres des autres rapports ayant trait à la roche tendre et à l'exploitation à ciel ouvert publiés au cours des deux dernières décennies ne figurent pas au répertoire.

À des fins d'organisation, les titres des rapports sont classés dans l'ordre chronologique dans les catégories suivantes:

- Vérification de la roche et classification
- Mesure des contraintes et appareillage
- Autre appareillage
- Géologie structurale
- Modélisation (mathématique, physique, assistée par ordinnateur)
- Systèmes de soutènement
- Exploitation par chambres et piliers (Elliot Lake)
- Exploitation par déblayage et remblayage y compris le contrôle du remblayage
- Exploitation en vrac (Sudbury, Algoma, Kidd Creek)
- Coups de toit et sismicité
- Manuels et études récentes

Ce répertoire comprend les titres de 251 rapports.

Nota - La version française des titres des rapports n'est pas disponible ceux-ci n'ayant été publiés qu'en anglais.

ROCK TESTING AND CLASSIFICATION

VÉRIFICATION ET CLASSIFICATION DES ROCHES

1. Ladanyi, B. "Uniaxial testing of rocks for classification purposes"; FMP 64/141-MRL.

2. Parsons, R.C. "Uniaxial compression tests for Black Hawk Mining Limited"; FMP 64/166-MRL.

3. Larocque, G.E. "Determination of the dynamic tensile strength of a series of magnetite specimens from Carol Lake, Labrador"; FMP 65/9-MRL.

4. Parsons, R.C. and Sullivan, J.D. "Uniaxial study results of Nordic quartzite and conglomerate"; FMP 65/28-MRL.

5. Parsons, R.C. "Petrology and deformational behaviour of the Director Mine rock types"; FMP 65/55-MRL.

6. Barron, K. "Loading tests on the Wabana model report No. 11, Final Report"; FMP 65/108-MRL.

7. Parsons, R.C. and Sullivan, J.D. "Moduli determination for the Elliot Lake stress relief overcoring work"; FMP 65/137-MRL.

8. Coates, D.F. and Gyenge, M. "Plate load testing on rock for deformation and strength properties"; ASTM Rock Mech Symp, Seattle, Dec 1965.

9. Coates, D.F. and Parsons, R.C. "Experimental criteria for classification of rock substances"; Int J Rock Mech & Min Sci vol 3, 1966.

10. Parsons R.C. and Hedley, D.G.F. "The analysis of the viscous property of rocks for classification"; Int J Rock Mech & Min Sci, Mar 1966.

11. van Heerden, W.L. "Loading tests on core discs obtained from in situ stress relieving tests"; FMP 66/119-MRL.

12. Parsons, R.C. "Triaxial test results on Carol Lake ore"; FMP 66/129-MRL.

13. Zahary, G. "Modulus of rigidity from pressuremeter tests"; May 1967; MRC IR 67/11.

14. Yu, Y.S. "Diametrical compression tests for the Elliot Lake strain-relief overcoring work"; May 1967; MRC IR 67/13.

15. Parsons, R.C. "Testing the size-effect on strength of the Elliot Lake quartzite"; MRC IR 68/46-ID.

16. Hedley, D.G.F. and Herget, G. "Preliminary rock mechanics investigations at Gaspé Copper Mines Ltd"; MRC IR 68/72-ID.

17. Kostak, B. "Size effect in Elliot Lake quartzite"; MRC IR 68/89-LD.

18. McRae, A. "Rock tests in conglomerate, Elliot Lake, Ontario"; MRC IR 69/35-ID.

19. Kostak, B. "Strength distribution in Elliot Lake quartzite"; MRC IR 69/114-ID.

20. Cruden, D.M. "A theory of the static fatigue of rock under uniaxial compression"; MRC IR 69/123-ID.

21. Cruden, D.M. "The recovery of pennant sandstone from a uniaxial compressive load"; MRC IR 70/11-ID.

22. Herget, G. "Shear strength of some chlorite coated shear planes and some extension fractures in the siderite orebody at G.W. MacLeod Mine"; MRC IR 70/24-ID.

23. Coates, D.F. "Report of the general reporter for theme I intrinsic properties of rock masses"; MRC IR 70/50-LD.

24. Zorychta, H. "Mechanical rock breakage in situ progress report no. 1"; MRC MR 70/66-ID.

25. Barron, K. "Brittle fracture and ultimate failure of rocks, Part I. Isotropic rocks"; IJRMMS 8 6, 541-51, November 1971; MRC MR 70/67-ID.

26. Paulmann, H.G. "Strength anisotropy of rocks, investigation of rock of the 'Ruhr-Karbon'"; MRC IR 70/76.
(Translation of headings, figure captions, and definition of symbols in equations by G. Herget.)

27. Barron, K. "Brittle fracture initiation in and ultimate failure of rocks Part II: Anistropic rocks - theory"; MRC IR 70/86-LD.
(For publication in International Journal of Rock Mechanics and Mining Sciences, 553-563.)

28. Barron, K. "Brittle fracture initiation in and ultimate failure of rocks Part III. Anisotropic rocks - experimental results"; MRC IR 70/87-LD.
(International Journal of Rock Mechanics and Mining Sciences, 565-575.)

29. Herget, G. "Determination of elastic strain recovery in five-inch diameter drill core subsequent to coring"; MRC IR 70/92-ID.

30. Sage, R. "Survey of physical mineralogical characteristics of underground mines in Canada"; MRC IR 72/10.

31. Herget, G. "A cylindrical pressure vessel for testing 10-inch diameter specimen under a confining stress of up to 6000 psi"; MRC IR 72/24.

32. Herget, G. "Rock properties"; MRC IR 73/44.

33. Herget, G.; Unrug, K.; Capozio, N. "Shear strength and failure strains of geological and artificial fractures in siderite under triaxial conditions"; MRC IR 73/61.

34. Sage, R. and Coates, D.F. "Survey of physical mineralogical characteristics of underground mines in Canada"; MRC IR 73/67. (Mines Branch IC 306 13/VIII/1973.)

35. Everell, M.D.; Herget, G.; Sage, R.; Coates, D.F. "Supplementary report to theme 1 mechanical properties of rocks and rock masses"; MRC IR 73/102.

36. Herget, G. and Miles, P. "Triaxial shear tests on joints and sawcuts in Rock samples from an iron ore open pit"; MRC IR 73/131.

37. Gyenge, M. and Coates, D.F. "Suggested method on field deformability determination using plate test (surficial loading)"; MRC IR 74/17. (ISRM Commission on Standardization of Laboratory and Field Tests.)

38. Miles, P. and Herget, G. "Shear resistance of geological fractures in weathered and fresh rock"; MRC IR 74/137.

39. Zahary, G. and Lee, H. "Mechanical properties of a Gaspé rock"; MRP/MRL 75-16.

40. Herget, G. and Unrug, K. "Strength of mine pillars from laboratory tests"; MRP/MRL 75-40.

41. Miles, P. and Herget, G. "Uniaxial compressive strength from point load tests"; MRP/MRL 75-46.

42. De Korompay, V. "Effect of blasting on rock fissuration"; MRP/MRL 75-54.

43. Miles, P. "Standard triaxial compression tests on WN1 granite core specimens"; MRP/MRL 79-18(TR).

44. Herget, G. and Miles, P. "Shear strength of geological discontinuities with material bridges"; MRP/MRL 79-76(J).

45. Larocque, G.E. "Methodology overview - rock mechanics rock properties"; MRP/MRL 81-144(OP).

46. Gyenge, M.; Gorski, B.; Shimotani, T. "Strength determination of rocks at Copper Cliff South Mine"; MRP/MRL 82-8(TR).

47. Gyenge, M. "Laboratory test for post-failure strength properties of rocks"; MRP/MRL 82-33(TR).

48. Molson, J. "Development of a uniaxial stiff testing procedure"; MRP/MRL 82-38(TR).

49. Gorski, B. "The design and operation of a stiff triaxial assembly for post failure rock property testing"; MRP/MRL 82-81(TR).

50. Molson, J. "Stiff triaxial tests on Copper Cliff South Mine orebody rock"; MRP/MRL 82-141(INT).

51. Swan, G. "Some results from controlled testing by stiffening element in the 18MN press"; MRP/MRL 83-5(TR).

52. Swan, G. and Zonggi, S. "Prediction of shear behaviour of joints using profiles"; MRP/MRL 84-58(J).
(To be submitted for publication in Rock Mechanics & Rock Engineering.)

53. Swan, G.; Vaillancourt G.; Tirrul, L. "Shear resistance of Selbaie Mine joints"; MRP/MRL 84-96(TR).

54. Udd, J.E. and Wang, H. "A comparison of some approaches to the classification of rock masses for geotechnical purposes"; MRP/MRL 84-97(TR).

STRESS MEASUREMENTS AND INSTRUMENTATION

MESURE DES CONTRAINTES ET APPAREILLAGE

1. Barron, K. "Glass insert stressmeters"; FMP 64/123-MRL.

2. Grant, F. and Coates, D.F. "Field trials during 1963 on the USBM borehole deformation meter"; FMP 64/125-MRL.

3. Barron, K.; May, A.N.; Cross, H.E. "The Mines Branch stressmeter"; FMP 65/172-MRL.

4. Yu, Y. "Rock mechanics investigations at MacLeod Mines, 1965. (A preliminary analysis for stress-relief measurements)"; FMP 65/181-MRL.

5. van Heerden, W.L.; Szombathy, C.; St. Louis, A.V. "A new strain cell installing tool"; FMP 66/37-MRL.

6. Grant, F. "In situ strain measurements with encapsulated 45° Rosette strain gauges, 14 west extension drift, Nordic Mine, Elliot Lake, Ontario"; FMP 66/62-MRL.

7. van Heerden, W.L. "The effect of stress concentrations around boreholes on measurements of absolute
stress in rock"; FMP 66/68-MRL.

8. van Heerden, W.L. and Grant, F. "A comparison of two methods for measuring stress in rock"; FMP 66/112-MRL.

9. Zahary, G. "An interpretation of field stress measurements"; FMP 66/193-MRL.

10. Grant, F. "Stress measurements at Elliot Lake - In situ measurements in stope pillars using encapsulated 45° Rosette strain cells. October 1966"; MRC IR 67/9.

11. Udd, J.E. "Stress measurements in 1109 Pillar, Nordic Mine, Elliot Lake, Ontario, (Aug. 1967)"; MRC IR 67/48.

12. Zahary, G. "Stress measurements Kerr-Addison Gold Mines"; MRC IR 67/51-MRL.

13. Udd, J.E. and Grant, F. "Measurements of stresses in the abutment zones, Nordic Mine, Rio Algom Mines Limited"; MRC IR 67/52.

14. Gray, W.M. and Toews, N.A. "Analysis of accuracy in the determination of the ground stress tensor by means of borehole devices"; MRC IR 67/28.

15. Grant, F. "Pillar stress measurements in situ with the USBM borehole deformation meter in the Rio Algom Nordic Mine at Elliot Lake"; MRC IR 67/35.

16. Udd, J.E. "Preliminary calculations of stresses in the abutment zones, Nordic Mine, Elliot Lake, Ontario"; MRC IR 68/35-ID.

17. Grant, F. "Field stress measurements with encapsulated Rosette strain gauge technique at Rio Algom Nordic Mine, Elliot Lake, Ontario"; MRC IR 68/49-ID.

18. Zahary, G. "Temperature stability of strain cells"; MRC IR 68/50-ID.

19. Grant, F. and St. Onge, J. "The technique used at the Nordic Mine to measure in situ stress with the use of the encapsulated Rosette strain gauges"; MRC IR 68/52-ID.

20. Barron, K. "In situ stress measurement"; MRC IR 68/119-LD.

21. Gray, W.M. "Analysis of data from stress-measurement program at McLeod Mine, Algoma Ore Properties,
Wawa, Ontario"; MRC IR 69/11-ID.

22. Gray, W.M. "Analysis of data from stress-measurement program at Falconbridge Nickel Mines Limited, Falconbridge, Ontario. 6050 Level Overcoring - 1968"; MRC IR 69/12-LD.

23. Gray, W.M. and Barron, K. "Stress determination from strain relief measurements on the ends of boreholes; planning, data evaluation and error assessment"; MRC IR 69/23-LD (RS 110).

24. Gray, W.M. "Analysis of data from Stress-Measurement Program at Falconbridge Nickel Mines Limited. II-Mean values and standard errors of calibration constants from laboratory measurements"; MRC IR 69/106-ID.

25. Millar, W.J.R. and Bielenstein, H.U. "Field measurements for elastic-strain-recovery measurements using CSIR strain cells"; MRC IR 70/41-ID.

26. Udd, J.E. "Two interpretations of strain relief measurements in a uranium mine"; MRC IR 70/81-ID.

27. Herget, G. "Determination of three ground stress tensors at the G.W. MacLeod Mine, Wawa"; MRC IR 70/118-ID.

28. Bielenstein, H.U. and Barron, K. "In situ stresses"; MRC IR 71/22-ID. (Publ Proc 4th CSR&T and 7th CSRM).

29. Yu, Y.S. and Gray, W.M. "Strain equations for the CSIR triaxial strain cell. (September 29, 1971)"; MRC IR 71/41-ID.

30. Herget, G. and Hedley, D.G.F. "Rock mechanics instrumentation Part III: stress determinations with overcoring techniques"; MRC IR 71/79-ID.

31. Gray, W.M. and Toews, N.A. "Optimization of the design and use of the CSIR triaxial strain cell for stress determination"; MRC IR 71/94. (Published ASTM, p 116-134; Field Testing and Instrumentation of Rock STP 554 May 1974.)

32. Herget, G. "Variation of rock stresses with depth at a Canadian iron mine"; MRC MR 71/96.
(For publication IJRM & MS 1972, Vol 10; No.1, 37-51. Jan. 1973.)

33. Tan, B.K. "An interpretation of field stresses adjacent to selected Canadian mines"; MRC IR 71/107.

34. Herget, G. "First experiences with the CSIR triaxial strain cell for stress determinations": MRC IR 72/58.
(Published INT JRMMS, Vol 10, No.6, 509-522, November 1973.)

35. Herget, G. "Stress tensor determinations in a bedded lead-zinc orebody"; MRC IR 73/45.

36. Herget, G. "Ground stress determinations in Canada"; MRC IR 73/128.

37. Gray, W.M. "Calibration of triaxial strain cell for stress determination; application to data from the Sullivan Mine"; MRC IR 74/114.

38. Herget, G. "Stress determinations in the Sudbury area"; MRP/MRL 75-22.

39. Herget, G. and Oliver, P. "Groundstresses below 3000 Feet"; MRP/MRL 75-56(J).

40. Herget, G. "Field testing of modified triaxial strain cell equipment at Timmins, Ontario"; MRP/MRL 77-2.

41. Miles, P., Herget, G. "Stress determinations at Creighton Mine, Sudbury district, Ontario"; MRP/MRL 77-81(TR).

42. Herget, G.; Miles, P.; Zawadski, W. "Equipment and procedures to determine the in situ stress field in one drill hole"; MRP/MRL 78-10(TR).

43. Herget, G. and Miles, P. "Stress determinations of the heater test site, Copper Cliff, Ontario"; MRP/MRL 78-53(TR).

44. Muir, B. "Ambient temperature calibration of 24 IRAD stressmeters"; MRP/MRL 79-106(TR).

45. Herget, G. "Regional stress in the Canadian Shield"; MRP/MRL 80-8(TR).

46. Herget, G. "Regional stresses in the Canadian Shield - a summary"; MRP/MRL 80-55(OP).

47. Herget, G. and Zawadski, W. "Improvements to groundstress determinations Part 1: laboratory tests"; MRP/MRL 81-17(TR).

48. Herget, G. and Oliver, P. "Pillar stress determinations at Copper Cliff South Mine"; MRP/MRL 82-4(TR).

49. Herget, G. "Change of maximum & minimum horizontal stress components with depth"; MRP/MRL 83-94(INT).

50. Arjang, B. "Field stress determinations at Selbaie Mine, Québec"; MRP/MRL 84-55(TR).

51. Herget, G. "Load assumptions for underground excavations in the Canadian Shield"; MRP/MRL 84-82(J).

52. Arjang, B. "Stress determinations at Stanleigh Mine, Elliot Lake, Ontario"; MRP/MRL 84-119(TR).

OTHER INSTRUMENTATION

AUTRE APPAREILLAGE

1. Larocque, G.E. "A sonic system for the determination of in situ dynamic properties and for the outlining of Fracture Zones"; (6th US Rock Mech Sym, Rolla Oct 1964).

2. Barron, K. and Cross, H.E. "Some experiments on the creep of photo-elastic coatings"; FMP 65/6-MRL.

3. van Heerden, W.L. "A compressometer using differential transformers"; FMP 65/175-MRL.

4. Hedley, D.G.F.; Yu, Y.S.; St. Louis, A. "A multi-wire extensometer for axial deformation measurement in long boreholes"; FMP 65/178-MRL.

5. Hedley, D.G.F. "An optical method of measuring the vertical deformation of a pillar"; FMP 66/35-MRL.

6. Hedley, D.G.F.; Yu, Y.S.; Montone, H.B. "Laboratory calibration of an electrical extensometer"; FMP 66/89-MRL.

7. Yu, Y.S. "Sonic measurements at Nordic Mine, Rio Algom Mines Limited, Elliot Lake, Ontario"; FMP 66/189-MRL.

8. Vanderzee, T.J. "Evaluation of the borehole penetrometer for estimating rock strength"; FMP 66/191-MRL.

9. Hedley, D.G.F. "Laboratory calibration of an electrical-mechanical multi-wire extensometer"; MRC IR 67/12-MRL.

10. Sinclair, B.J. "Sonic velocity and attenuation measurements at Nordic Mines, Elliot Lake, Ontario"; MRC IR 67/53-MRL.

11. Hedley, D.G.F. and Zawadski, W. "Laboratory testing of the USBM explosive anchor"; MRC IR 67/56-MRL.

12. Hedley, D.G.F. "Laboratory calibration of the terrametrics Model F-2 extensometer"; MRC IR 68/31-ID.

13. Kostak, B. "A new device for in situ movement detection and measurement"; MRC IR 68/37-ID.

14. Korczynski, P. "Shear strip tests"; MRC IR 68/83-LD.

15. Hedley, D.G.F. "Design criteria for multi-wire borehole extensometer systems"; MRC IR 69/68-ID.
(CIM, p 100 for Proceedings Notice; July, 1971.)

16. McRae, A. "Horizontal tape extensometer"; MRC IR 69/109-ID.

17. Barron K. and Hedley, D.G.F. "Rock mechanics instrumentation - Part IV: rock bolt load cells"; MRC IR 71/80-ID.

18. Larocque, G.E.; Kapeller, F.; Coates, D.F. "Seismic and bore hole photographic measure"; MRC IR 72/76.

19. Herget, G. and Unrug, K. "Instrumentation to determine the influence of roughness on the shear resistance of fracture planes in rock"; MRC MR 72/95.

20. Larocque, G.E.; Kapeller, F.; Coates, D.F. "Refraction seismic measurements and borehole observations in an open pit"; MRC IR 72/111.

21. Herget, G. and Unrug, K. "Four-point borehole strain meter"; MRC IR 72/154.

22. Kapeller, F. and Larocque, G.E. "A rock bolt dynamometer system using continuous vibrating wires"; MRC IR 73/36.

23. Larocque, G.E. and Kapeller, F. "A borehole camera"; MRC IR 73/46.

24. Hedley, D.G.F. "Notes on rock movement measured with borehole extensometers"; MRC IR 73/151.

25. Miles, P. and Herget, G. "Penetrometer tests in drill holes"; MRC IR 74/43.

26. Hedley, D.G.F. "Mining research at the Kidd Creek Mine, Timmins Part 5: Open pit and underground deformation measurements"; MRP/MRL 76-67(TR).

27. Muir, B. "Ambient temperature calibration of 24 IRAD stressmeters"; MRP/MRL 79-106(TR).

28. deKorompay, V. "A vacuum hole monitoring system to detect fractures in mine roof"; MRP/MRL 80-87(TR).

29. Herget, G. "The ST-6 borehole TV system"; MRP/MRL 81-122(TR).

30. Herget, G. "Borehole dilatometer for backfill studies"; MRP/MRL 82-2(TR).

31. Gorksi, B. "The design & operation of a parallel stiff compression apparatus"; MRP/MRL 84-36(TR).

32. Gorski, B. "A multi-shear apparatus"; MRP/MRL 84-44(TR).

STRUCTURAL GEOLOGY

GÉOLOGIE STRUCTURALE

1. Bain, I. "The geological structure and probable rock stress environment in the Quirke syncline and particularly in the Algom Nordic Mine test area, Elliot Lake, Ontario"; FMP 65/106-MRL.

2. Parsons, R.C. "Determination of preferred planes of weakness in geological materials Part I"; FMP 66/122-MRL.

3. Everell, M.D. and Parsons, R.C. "Determination of preferred planes of weakness in geological materials Part II"; FMP 66/152-MRL.

4. Parsons, R.C. and Cook, S. "Photo electric scanner for the counting of discontinuities on rock surfaces"; MRC IR 67/69.

5. Parsons, R.C. "Fracture systems in the host granites at Newfoundland Fluorspar operations"; MRC IR 67/70.

6. Udd, J.E. "A study of fracture patterns at the Nordic Mine, Elliot Lake, Ontario"; MRC IR 68/36-ID.

7. Herget, G. "Structural investigations of 167 and 228 pillars at McLeod Mine, Algoma Ore Properties,
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